The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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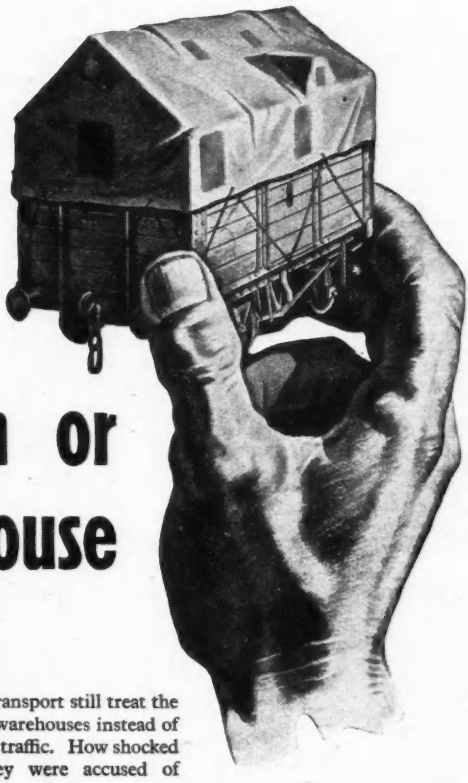

Wagon or warehouse ?

TOO many users of transport still treat the nation's wagons as warehouses instead of putting them back into traffic. How shocked they would be if they were accused of obstructing the war effort.

"One wagon out of tens of thousands!"

"It was only three days at our sidings."

But *in total*, hundreds of wagons stand idle for thousands of days—a huge loss to our vital transport system in its colossal war tasks. Will you take steps now to see if you are an unwitting "offender"?

QUICKER TURNROUND THAN EVER BEFORE

Issued by the Ministry of War Transport

You know your own problems best. Tackle them in your own way. But tackle them now. Plan, encourage ideas, improvise if needs be. Here's a starting-off agenda:

1. CLEAR LABELS AND DOCUMENTS.
2. LABOUR SAVING DEVICES.
3. WORK IN BLACK-OUT AND AT WEEK-ENDS.
4. OPINIONS OF "MEN WHO DO THE WORK".

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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A Chemico-Biological Mystery

ON a previous occasion attention was called in these columns to Professor H. V. A. Briscoe's work on the properties of dusts in relation to silicosis. While this work did not, as was hoped, result in the discovery of a connection between the physical and chemical properties of silica and the incidence of the disease, the work disclosed some remarkable and unexpected properties of fine mineral dusts. Some of these properties were later discussed by Professor Briscoe in a series of Cantor Lectures to the Royal Society of Arts, and it is worth while to direct attention to this work in order that it may receive the recognition it undoubtedly deserves.

The experiments here recorded were made in connection with the control of the weevil, a little insect that is so destructive of grain that in the U.S.A. alone it is calculated to destroy $300,000,000 worth each year. The approach to the subject, which was that of the chemist, was governed by the single assumption that as some dusts are highly effective and others are not, there must be some property of dusts, chemical or physical, which is responsible for killing weevils. An attempt was made to discover that property, using the insect as a "reagent," a method which Professor Briscoe believes to be new as applied to inorganic materials of this type. The physics of the colloidal properties of dry dusts is largely unexplored as yet. One essential difficulty of research on this subject is that of producing particles of different size having identical surface properties; that this was an important factor was shown by the fact that the present experiments demonstrated quite clearly that it is possible to have two powders, identical in chemical composition, particle size, and crystalline form, which yet differ vastly in biological activity against insects.

The general method used was to place 50 weevils selected at random from several thousand into 50 gm. of wheat in equilibrium with air of 70 per cent. humidity, containing 1 per cent. of the dust under test. At intervals of 2-3 days the weevils were separated from the wheat and the number of dead counted, comparison being made against a control test without the addition of dust. An *S*-shaped toxicity curve was found and the relative effect of different dusts could be calculated from the time taken for a 50 per cent. death-roll. One

On Other Pages

of the first conclusions was that the chemical properties of the dusts were unimportant. This does not mean, of course, that poisonous dusts were not effective—they are more effective than non-poisonous dusts—but among those dusts that have no poisonous action when eaten, chemical properties had little or no significance. When this conclusion was reached, it was decided to try "the most chemically pure substance we could think of: fine diamond dust ($1\mu - 10\mu$)", purified by cleaning and by subsequent treatment with benzene, ether, HF, and boiling aqua regia, followed by washings with water, alcohol, and ether. Surprisingly, this material proved to be far more effective in killing weevils than any of the dusts previously tried; it was then found that powdered carborundum was almost equally effective. This raised the problem of how these dusts operated—a problem that still defies complete solution. Dissection showed that the dusts do not penetrate the respiratory system, and though the weevil cannot avoid eating some of the dust with its food, this is not the chief cause of the action: "the main effect is due to an action on the outer casing of the insect so curious that one could hardly have anticipated its possibility."

It is known that humidity is particularly important in the biology of insects because, being small, they have a relatively large surface area, and so the loss of water by evaporation is a very serious matter, especially for those species that live on dry food. The moisture content of grain normally lies between 12 and 18 per cent. by weight, but the weevil living on it contains 50 per cent. of water, and if this figure falls below 30 per cent. the insect dies; it cannot live at all on grain containing less than 10 per cent. of water. Experiments suggest that humidity has a marked effect on the toxicity of inert dusts and that the presence of dust somehow increases the loss of water by the insect. When insects are killed by dust their tissues are found to be shrivelled and desiccated. The rate of loss of weight by a batch of starving insects is markedly increased by dusting them, and this is due to loss of water and not of CO_2. The effective dusts do not themselves absorb water from the insects—some of them, like diamond and carborundum, are quite incapable of doing so—but they function by promoting the loss of water. It is still a mystery why this should be so and in the Cantor Lectures Professor Briscoe pursues a number of speculations with experimental evidence upon this rather puzzling action.

It is found, for example, that *intrinsic hardness* bears an important relationship to effectiveness; materials having a hardness below about 3 on Mohs' scale are ineffective. But this is not the only criterion, some soft materials being abnormally effective, and some hard materials ineffective. The suggestion is made that the real effect is not hardness, but some property related to hardness, and that it may be the ability of the particles to retain their sharpness even on a sub-microscopic scale.

Experiments with membranes have shown that a thin layer of a suitable dust can largely increase the rate of passage of water through an otherwise impermeable membrane. This may be regarded as a rough analogy with what happens when dusting insects. Here is Professor Briscoe's own conclusion: "If it be accepted that dusts act by affecting the permeability of a fatty film, there remains the question of the nature of this action. Here we enter the realm of pure hypothesis. The explanation rests on two points: firstly, that the waxes which are effective in the membrane experiments are polar in character; and secondly, that the hard sharp dusts which characteristically produce the observed effects on the wax film are likely to exhibit, even on their minutest edges and corners, a substantially unimpaired molecular lattice on the surface. It is conceivable then, that where this lattice touches the membrane, the covering film may be attracted and so induced to leave the relatively structureless surface on which it lies and cling to the crystal, leaving a bare patch on the membrane. Even if the holes so made formed but a small part of the total surface they could still account for the observed phenomena since . . . the rate of diffusion of a vapour through many small holes is much greater than through a single hole of equivalent total area."

NOTES AND COMMENTS

Vacation Work

WE have received from the Vacation Work Committee of Imperial College a report of a conference held two months ago to discuss the operation of the scheme by which students are enabled to gain industrial experience during the holidays. We assume the committee wishes us to give some publicity to this report. We do so gladly, for the publication has great interest, but we should like to point out in this connection that it would have been no more than common courtesy to have invited the technical press to the conference itself. This particular vacation scheme started in 1933, as an attempt to introduce engineering students to industry in an experimental way. It was soon extended to bring in other science students, and the success of the experiment may be judged from the fact that during the 1942-43 session 488 students registered for work, while the number of firms co-operating was no less than 226. These firms included such well-known names as Bakelite, BX Plastics, High Duty Alloys, Hopkin and Williams, I.C.I., Kestner Evaporator Co., May and Baker, National Smelting Co., Pinchin Johnson, and Roche Products.

How Industry Gains

THE report of the conference is most illuminating, and we hope that everyone who has access to a copy will read it. Most of the speakers seemed to have no doubt at all about the soundness of the scheme, recognising it as a valuable means of attracting the student towards an industrial career. Incidentally, it is quite clear that research makes a bigger appeal to the present generation of science students than does factory practice and control. As Dr. C. H. Clarke, of Lever Bros., said at the conference, the student seems to have a ready answer to the invitation "Would you like to go into a research laboratory?" whereas he does not know what a job in the works means and therefore has no views at all when asked "Will not a job in the works suit you?" Vacation courses on the Imperial College lines provide him with experience and background which will start him thinking about the second question. The need for the student to be given a bird's-eye view of the whole factory before putting him to work in a particular department is worth noting, though we are inclined to think that the average worker has an equal right in regard to this point. A detached part of a jigsaw puzzle is of no significance apart from the complete picture! The conference also discussed pay. There is a lot to be said for one suggestion that the rate for vacation work should be stabilised, with a billeting allowance to ensure that the student who has to live away from home does not lose money through accepting vacation work. We cannot support too strongly the argument that the value of such vacation experience should be assessed from the national point of view. An individual firm may have doubts about giving industrial experience to a student who may take a job with a different firm after graduation. Well, that firm has a fair chance of obtaining another graduate who spent his vacations with a different firm. Industry as a whole will benefit if individual firms will take it upon themselves to stimulate the student's interest in an industrial career. In the long run industry will extract the greatest benefit from this and other schemes if individual firms aim at giving the student something of value, rather than try to get something out of the student.

Hello, Wilmington!

LAST week the B.B.C. broadcast a "Transatlantic Call" from Wilmington, Delaware, which gave listeners a sound-picture of this town, described by the commentator as the G.H.Q. of America's chemical industry. The radio tour took in the plants of the Hercules Powder Co. and the Atlas Powder Co. Bad transmission, and the over-amplification of a gurgling still made it rather difficult to hear, but we believe we are right in saying that the Bayer plant was also included. We were glad to have the opportunity of meeting chemists and workers associated with the production of nylon, neoprene, freon, mannitol, and explosives. From a technical point of

view, the testing of a charge of dynamite came over best, and no doubt British listeners were impressed with the story of photographing an explosion with a camera through which the film is fed at the rate of a tenth of a mile a second. It was also interesting to find what a large number of women are engaged in the American chemical industry, as both operators and research workers. We could not help feeling, however, that the British school of documentary producers could have turned out a most realistic picture of what Wilmington and its industry are really like. We suggest that the B.B.C. should try its hand at a similar feature about a chemical town such as Widnes, with the proviso that it must not be made to appear like a modern Inferno.

British Association of Chemists

New Officers Elected

THE 26th annual general meeting of the B.A.C. was held at the Café Royal, London, on February 19. The chair was taken by the President, Dr. A. E. Dunstan. After the presentation of the Hinchley Medal to Mr. H. W. Rowell, and the adoption of the financial report, the council's report for the past year was read, showing the membership to have increased by 9, making a total of 2434. Negotiations for representation of the Association on the Chemical Council had taken place, but although the chairman of the chemical council, Dr. L. H. Lampitt, recommended to the three constituent members that representatives of the B.A.C. should be co-opted on to the council, the Chemical Society failed to agree. Dr. Lampitt has informed the Association that the reconstitution of the chemical council is foreshadowed and an invitation to the Association to discuss the development of the chemical council has been promised "as there is agreement on the desirability of the British Association of Chemists being consulted in these matters."

The election of officers resulted as follows: *President*: Professor R. G. W. Norrish, F.R.S. *Vice-presidents*: Professor I. M. Heilbron, F.R.S.; Dr. Paul Haas; Mr. W. H. Woodcock; Miss W. Wright; Mr. H. N. Linstead, M.P. *Hon. Registrar and Hon. Secretary*: Professor E. C. C. Baly, F.R.S. *Hon Treasurer*: Mr. W. C. Peck. *Hon. Editor*: Mr. T. Crosbie-Walsh.

The new president said he accepted office with one reservation, *viz.*, that he would strive to support any progressive movement and any development in the Association which, in his view, made it a more comprehensive trade union. At the present moment it was necessary to re-orientate their views with regard to the work of the Association not only internally but also externally and nationally. Therefore, he wished the members to remember that in the work of reorganisation he would be on the progressive side.

Parliamentary Topics

By-Products (Extraction)

IN the House last week Mr. Ellis Smith asked the Minister of Fuel and Power what steps were being taken to bring about the complete scientific utilisation of coal to extract the maximum by-products.

Major Lloyd George said that during the war marked progress had been made, particularly through the work of the Fuel Efficiency Committee, in increasing the efficiency with which coal is utilised. At the same time, a considerable increase had been achieved in the completeness of the extraction of important by-products from gas and coal tar. A considerable volume of research work was in progress by the Fuel Research Station and the research associations of the fuel industries, and plans were being made for the expansion of this work. He regarded this as a matter of great urgency, and he thought his questioner would probably be a little surprised at the progress made.

I.C.I. Billingham Plant

Mr. A. Edwards asked the Minister of Fuel and Power what terms were agreed between the I.C.I. and the Government when the oil-from-coal plant was erected at Billingham, and to what extent a commercial risk was involved.

Major Lloyd George: In July, 1933, the Government announced their intention of introducing legislation to give a guaranteed preference on home-produced motor spirit over a period of years, and I.C.I. accordingly decided to proceed with the erection of this plant. A commercial risk was undoubtedly involved, as the process was new to this country. The risk was taken by Imperial Chemical Industries.

Fertiliser Act Contravened?

Mr. Rothschild asked the Minister of Agriculture whether his attention had been called to the complaints by the farmers that, in contravention of the Fertilisers and Feeding Stuffs Act, 1926, many fertilisers do not maintain their declared figures of analysis, being particularly deficient in potash, and whether he was taking any steps in the matter. Mr. Hudson said he would communicate with the questioner.

FUEL ECONOMY IN THE CHEMICAL INDUSTRY

Fuel Efficiency Lectures

VI.—Economics of Methods of Producing Vacua

by J. MALLEY

IN chemical plants, jet condensers are more commonly used than are surface condensers for the condensation of vapours and production of vacua. Operating in conjunction with these condensers there may be a reciprocating air pump, a rotary air pump, or a steam-ejector air pump of the single or multi-stage type, while sometimes the condenser may be an ejector condenser. If the condenser is of the barometric type, an injection water pump will be required, and this may draw from a river or from a cooling pond. Since the ejector condenser requires a very large volume of water for operation, its application is limited to situations where large quantities of water are available. Inefficient operation of many vacuum-producing plants is generally due to a lack of sufficient water at a reasonable temperature; often no arrangements are provided for cooling the injection water. Spray nozzles are allowed to choke, or sufficient head is not provided at the nozzles to get the effective spraying necessary to give the required degree of cooling. The water pressure at the nozzles of spray ponds should not be less than about 10 lb./sq. in., so a suitable spray-pond pump will be necessary if the condenser is of the barometric type as it is generally not set high enough to give this pressure head.

Operators have been known to argue that they have had to throttle the supply of water to the spray pond to a pressure less than 10 lb./sq. in. to prevent excessive loss from the sprays by evaporation. This means that the operators have not appreciated that, with sprays, cooling is obtained by evaporation and that unless free evaporation takes place, the water will not be cooled sufficiently; consequently, the vacuum in the condenser will be affected. In one instance, where a low-level jet condenser fitted with a water-extraction pump was installed, cavitation troubles, due to unnecessary throttling, had also been experienced in the extraction pump. When the delivery sluice valve was opened up and the full head put on the sprays, the cavitation troubles disappeared and there was a marked reduction in the outlet temperature of the water from the spray pond. Of course, the system then required a greater amount of make-up water to replace that lost by evaporation.

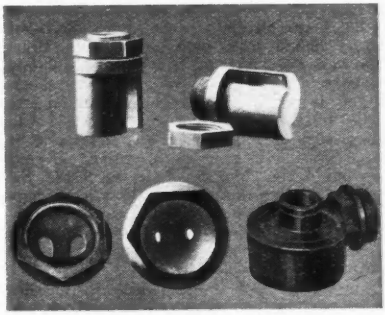


Fig. 1.

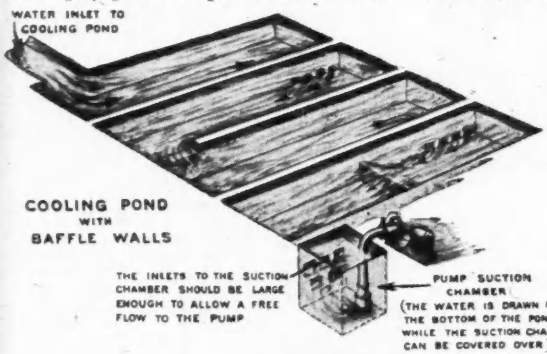


Fig. 2.

Fig. 1 shows different types of nozzles used in spray ponds. These are not equally efficient, but the more efficient types are the more easily choked in operation. Therefore, in deciding on the type of spray, the engineer will make up his mind whether he can afford to shut down for frequent cleaning of nozzles and get reasonably good efficiency, or use a less efficient nozzle, but one less susceptible to choking. Trouble may also be experienced through the fouling of the condenser by dead leaves or other foreign matter which finds its way into the piping, eventually causing a choke inside the condenser, impairing efficiency and reducing the vacuum in the system.

Inefficiency arising from too high a tempera-

ture of the water from a cooling pond may be due to the injection water being drawn from the top of the pond instead of from the bottom, where the water may be several degrees cooler. This is more likely to be found in ponds where spray cooling is not in operation. In ponds not fitted with cooling sprays, baffle walls which direct the flow of the cooling water can be useful in preventing the hot water from the condenser short-circuiting to the injector pump suction while giving time for a certain amount of cooling by surface evaporation. Fig. 2 shows a baffle wall at the injection pump suction to ensure that the pump draws water from the bottom of the pond, and also to prevent leaves and other floating debris from being drawn in. Brick baffle walls are indicated, but are not absolutely necessary. In emergency, old corrugated sheeting held in position by long stakes driven into the bed of an existing pond could be tried. Old timber, such as railway sleepers, could also be used if availble in sufficient quantity. If with the pond baffled in the manner suggested, the degree of cooling is not adequate, the management must decide whether the extra consumption of power for driving a spray-pond pump to get an improved vacuum is justified in their particular process.

The arrangement of the baffling in the condenser also has its effect on the degreee of vacuum obtainable. As an example, a jet condenser had been operating for many years and maintained a vacuum of only about 23 in. Hg. By reversing one of the baffles inside the shell (Fig. 3), the vacuum in that condenser was improved by about 2 inches. The bottom baffle, as originally arranged, directed the cooling water away from the vapour, whereas

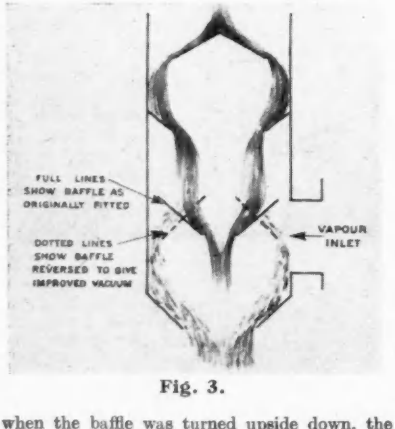


Fig. 3.

when the baffle was turned upside down, the cooling water and the vapour mixed intimately.

Sometimes the vacuum maintained by a jet condenser can be improved by increasing the depth of the body, and adding to or modifying the existing baffling. In a short condenser body the path of the vapour through the baffles may be too short, with the result that all the condensable vapours may not be condensed, thus causing the air pump to be overloaded by dealing with vapour at an unnecessarily high temperature. A comparatively simple modification to the condenser might make all the difference (Fig. 4). The condenser on the left was not quite up to its work, but, on being modified as shown on the right, the difficulties were overcome.

In certain batch processes, it is necessary to break the vacuum intermittently in the operating vessels, a number of which may be coupled to a common vacuum-producing system. When this occurs, it is frequently undesirable to put the vessel which is at atmospheric pressure, straight on to the condenser, as this may disturb

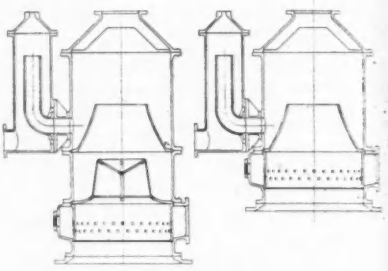


Fig. 4.

the operation of the other vessels in the system which are operating under vacuum. A simple means of overcoming this trouble is to fit a single-stage steam-ejector air pump to build up a vacuum in the vessel which is isolated, so that it can be brought into the main vacuum system without seriously affecting the operation of the rest of the plant. The steam-ejector air pump can be coupled to all the vessels, so that it can be used whenever any of them is being put back into the system. The steam consumption of this single-stage ejector operating during the few minutes necessary is not very high, but many operators have found it a great boon in the successful working of their process. Such an ejector is capable of building up a vacuum of 26 in. Hg in the vessel. In expressing the degree of vacuum in inches Hg, a standard barometric pressure of 30 in. Hg is assumed.

Among the reciprocating types of air pump used in conjunction with condensers, one still finds an occasional Edwards Air Pump, although these were more frequently installed in conjunction with surface condensers as wet air pumps. When used as a dry air pump they require a supply of operating water, but they generally need little attention if they have been properly adjusted. However, when wear occurs their volumetric efficiency is likely to deteriorate and the vacuum in the system to be adversely affected. In an Edwards air pump, the clear-

ance in all the barrels should be carefully adjusted if they are to work reasonably efficiently. Reciprocating dry air pumps generally require fairly frequent overhaul, whether they are of the slide-valve type or are fitted with clack valves of the Hoerbiger-Rogler type. The latter have the better mechanical efficiency, although the former have a higher volumetric efficiency, but in both types the vacuum may be affected if excessive wear takes place, leading to expensive overhauls, especially if the vapours dealt with are of a corrosive nature.

Rotary air pumps of the Leblanc type are sometimes used to maintain vacuum in chemical plants. They require a supply of water in their operation, and they can be driven by electric motor or steam engine. They are fairly expensive to manufacture, and some require frequent overhaul and repair, depending on the duty they are called on to perform. One advantage they have over the reciprocating air pump is that they occupy less space.

The most modern type of air pump is the steam ejector. Provided that steam at a pressure of not less than 80 lb./sq. in. gauge is available to operate the ejector, this, in its

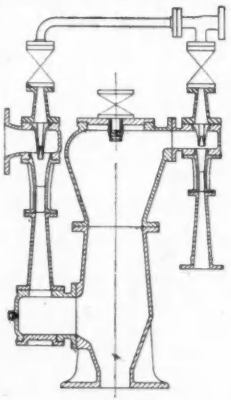


Fig. 5.

different combinations, is the most versatile of air pumps. Compared with the other types, it is low in first cost, and it is easy to operate. It will function for long periods without any loss of vacuum and its maintenance costs are light. In a barometric condensing plant, it can be placed close to the condenser, thus cutting out the long length of air-suction piping required when any of the other types of air pump mentioned are installed. It can be manufactured in special materials to suit special conditions at prices which are not prohibitive. It occupies very little space. No claim can be made for it that it is thermodynamically more efficient than the other types of pump, but, provided that the operating steam is called on to entrain and compress only comparatively inert gases, this steam can be used for heating purposes, either in a tubular heat-exchanger or by direct contact. It is cleaner than steam which has been first used in

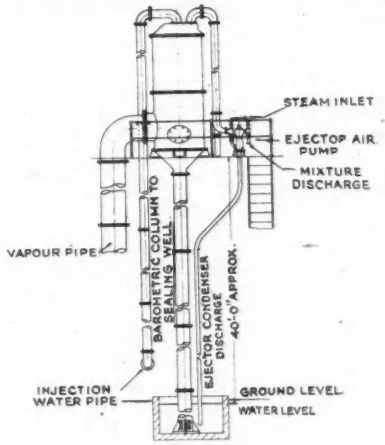


Fig. 6.

the cylinder of an engine to drive any of the other types of air pump mentioned, being quite free from lubricating oil. The ejector can also be designed to operate with steam at high pressures and a high degree of superheat which reciprocating steam engines could not cope with.

For use in conjunction with a jet condenser designed for a vacuum of from 24 in. up to, say, 28 to 28½ in. Hg, a two-stage ejector with an intermediate jet condenser is generally supplied. A water supply is led to the intermediate jet condenser, and this water condenses the steam and vapour coming over from the first ejector operating stage (Fig. 5). The drain from this intermediate condenser is led away through a drain pipe connected to the bottom of the condenser. In an ejector operating in conjunction with a surface condenser or a low level jet condenser, this drain is led either through a U-leg or through a trap into the main condenser. The U-leg or trap is necessary because of the difference in absolute pressure between the main condenser and the small intermediate condenser of the ejector. When installed with a barometric condenser, the ejector condenser drain is led down to the sealing water sump of the main condenser. Drainage details are rather important if the ejector air pump is to operate satisfactorily. Fig. 6 shows a simple arrangement of a two-stage ejector coupled to a barometric condenser.

A special application of the steam-ejector air pump is its use as a single-stage pump drawing from a vessel in which a particularly low pressure is required (to within, say, + 5 mm. absolute). The ejector here does not draw vapour from a condenser, but from the process

vessel, and it then delivers the vapour into a condenser of the usual type, which, in turn, is fitted with an air pump of the ejector, reciprocating, or rotary type, maintaining a vacuum of about 28 in. Large installations of this type are quite common to-day. One particular application is the cooling of liquids in process by as much as 17°C. at one step, but the liquid to be cooled must be sprayed into the vessel from which the single-stage ejector (or vapour compressor) is evacuating the vapours, otherwise no appreciable cooling will result. The reason, of course, is that if the vessel has a depth of several feet of liquid in it, the hydrostatic head is such that it is physically impossible to cool the layers of the liquid.

In some processes, vacuum plant may be in use which is not capable of maintaining a vacuum as high as might be desired. The single-stage ejector air pump used as a vapour compressor or backing pump can often be employed to obtain the desired degree of vacuum, but the assistance of an expert is desirable in deciding whether or not the conditions are suitable for this adaptation.

It is not proposed to deal with surface condensers here, beyond mentioning that, strange as it may seem, surface condensers are occasionally installed which are too large, and, in consequence, give poor results. The speed of circulating-water flow through the tubes was so low that matter in suspension in the water settled out in the tubes at such a rate that they had to be cleaned weekly—a long, tedious job. The condensers were not large, but by plugging a few hundred tubes to increase the speed of flow, the operation of the plant was much improved. To reduce yet further the time required for cleaning, a tube-cleaning apparatus was fixed permanently on the end door of each condenser. The apparatus is arranged to circulate a hot soda solution through the tubes, the plant being shut down when this becomes necessary (Fig. 7).

Discussion

Q. If deposition in surface-condenser tubes occurs to such an extent that it is necessary to clean mechanically every week, should not the water be treated ?

A. In the particular case referred to, the works were drawing their water from a river downstream from a sewage works, so that there was a good deal of filth with which to contend. There was rather a lot of solid in suspension, but the experience was quite usual with river waters carrying much solids in suspension. With scale-forming water, a hydrochloric acid solution of limited strength should be used instead of a soda solution. It might take some time to boil the tubes clean at first, but afterwards it need not take so long. The tubes should then be washed out with an alkaline solution to neutralise the effects of the acid.

Q. In the paper, reference is made to an ejector air pump used in conjunction with a barometric condenser. The drain from the intermediate jet condenser of the ejector is run into the pit for the barometric condenser. Would it be a good proposition to use a separate pit for the condensate water, and use the condensate with the ordinary condenser water system for the feed ?

A. It could be done, or instead of an intermediate jet condenser on the ejector, we could have an intermediate surface condenser. The cooling water that was taken through the tubes of the intermediate ejector could be used to condense the first-stage operating steam. To carry it still further, a surface condenser could also be installed to condense the steam from both operating jets.

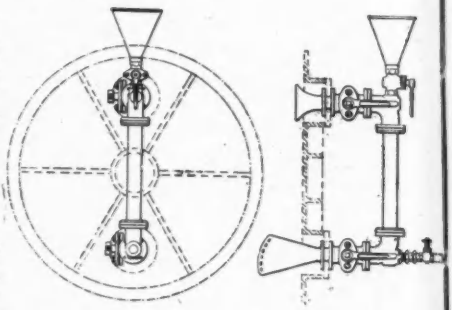


Fig. 7.

Q. In the use of the jet condenser, is it always necessary to have a barometric leg, or can a pump be used to pump the water out ?

A. It is not necessary to use a barometric condenser. One could use a low-level jet condenser. This would be at ground level and then a water-extraction pump would be required. No matter what arrangement is used, however, a pump is generally necessary. The barometric jet condenser requires an injection water pump, as the vacuum in the system is not sufficient to provide the pressure difference to pull the cooling water into the condenser. With the low-level jet condenser, the vacuum in the system pulls the cooling water in, but a pump is necessary to get it out again.

Q. What is the power required to maintain a vacuum of 24 in. in a vessel, and is an allowance of 4 h.p. per 100 cu. ft. of cylinder the normal figure ?

A. With a reciprocating air pump, much depends upon the type of pump. For example, a slide-valve type is less efficient mechanically than a clack-valve. Some air pumps require a considerable amount of power to start them, but once they have got under way the power consumption is considerably reduced.

Q. Is there any difficulty in fully condensing the steam from an ejector used for producing a vacuum industrially in a main condenser ?

A. No.

Q. The main difficulty appears to be that the

steam and air are so intermixed, that a surface condenser requires a very big area to condense the steam fully.

A. A surface condenser built to modern designs does not require to be very large for a particular duty, but the quantity of cooling water required is greater than that required for a jet condenser designed to do the same job. On the other hand, the air pump for use in conjunction with a surface condenser is smaller and requires less power than does the air pump which operates with a jet condenser for the same duty.

Limits of Capacity

Q. Can an economic line be drawn as far as the saving of power similar to that obtaining in grinding machinery? It would seem that a very definite line can be drawn where the limit is reached of the capacity of the ordinary vacuum pump. Several factors affect this, such as the capacity of the apparatus and the corrosive nature of the material being handled, but in general it would be about 28½ inches. Above this figure, is not the ejector air pump the only really practical solution? There is a colossal jump in steam or power consumption as soon as one has to resort to these units. The limitations of the ordinary pump, reciprocating or rotary, are purely mechanical, but are very real. It is difficult, for example, to keep stuffing-boxes tight with vacua as high as 29 inches. There are lubrication and valve difficulties, and all these things add up to what is rather a troublesome piece of apparatus at very high vacua. Is it not the best practice to work at as high an absolute pressure as possible to give the most economic unit the best chance of functioning satisfactorily?

A. For vacua above the figure mentioned (28½ in.) a steam-ejector air pump can be used as a backing pump working in conjunction with a mechanical pump. The ejector builds up to the vacuum required and discharges into a condenser in which the 28½ in. vacuum is maintained by the mechanical pump. If the ejector operating steam can be condensed in a surface condenser, using a process liquid which has to be heated in any case, the objection to the high steam consumption is overcome. However, it is not satisfactory to generalise, and each problem should be considered independently.

Q. Are not steam ejectors an economic proposition only where either there is a surplus of exhaust steam available or the steam from the ejector can be used for heating purposes? For ordinary purposes, a mechanical vacuum pump is a far more efficient means of producing vacuum than ejector air pump. Steam ejectors are useful for dealing with corrosive vapours. They are now being made in stoneware to quite fine limits but, in general, for the average chemical concern, is not the mechanical pump, whether it be a slow-speed reciprocating vacuum pump or one of the newer horizontal rotary vane types, the more economic proposition?

A. The normal ejector air pump will stand up for much longer periods than any type of mechanical pump. Maintenance and repair must be considered in relation to ejector air pumps. Though specially high efficiencies cannot be claimed for ejector air pumps as compared with mechanical pumps, the fact remains that the ejector air pump, if steam is available in sufficient quantities, is a better job than the mechanical pump, and reliability is one of the great points in its favour. If the operating steam can be used for heating purposes, the ejector air pump would be the better proposition. In the production of high vacuum, of the order of 10 to 15 mm. abs. pressure, it might be possible to get a mechanical pump to do the job satisfactorily, but an ejector will generally be found to be more reliable, although the steam consumption is likely to be fairly high.

Q. Would not steam be entirely lost in the first two stages of a three-stage ejector unless it could be used for heating water?

A. Only air ejectors with intermediate jet condensers have been here discussed, but air ejectors with intermediate surface condensers could be used, and then it is possible to recover practically all the heat in the operating steam.

Q. The questioner said he was interested in a distillation process in which it could almost be said that vacuum was one of the ingredients of the product and the cost of vacuum production was a considerable item in the cost of the product. The plant he was concerned with at present produced vacuum by a mixture of processes. The first stage of compression was carried out by a steam ejector and the final stage by a mechanical pump. The figures he had obtained were so startling that either he was seriously wrong or generalised statements were not sufficient to solve this problem.

Some Actual Figures

The chemical works using steam-jet ejectors was in a very different position from the large power station with its regenerative feed-heating cycle, in that it often suffered from a plethora of low-grade heat and he had found it very difficult to persuade anyone to design him a four-stage ejector using low-grade steam. The analysis of schemes for the use of ejectors was disappointing. They were based on steam at 8s. 6d. per 1000 lb. and electricity at 0.6 pence per kW. The actual figures did not matter very much as long as the same figures were used throughout. His present system used 225 lb. of steam per hour at about 30 lb./sq. in. at the ejector. The condenser was condensing 1200 lb. of vapour per hour. The vacuum was maintained at 0.8 in. absolute pressure, delivery to the pump being 1.6 in. abs. pressure. That was important, and was very different from working an ejector to take the compression all the way up to atmospheric pressure. That steam used was worth about £370 a year and the cost of the electricity for the mechanical pumps was £66 per year, added to which was £62 for the water for the pumps, making a total of about £500 for running a single

unit. That was the basis from which he started. The following comparisons were based on reliable guaranteed consumption figures for ejector schemes: Using two-stage ejector compression, 550 lb. of steam would be used per hour at a pressure of 120 lb./sq. in., and this was worth £916 per year. There was also £150 worth of water. The result was that the cost of maintaining the vacuum was £1060. With three-stage compression, this figure was brought down to about £700. With four-stage compression using steam at 35 lb./sq. in.—which could be called low-grade supply—the problem was how to cost this low-pressure steam and power, but for the purpose of the present argument, they could be taken as 50-50, and on this basis, the ejector cost £1260 per year.

Finally, he made a comparison with a mechanical two-stage high-speed pump. This was a vane type compressor, although it was open to question whether it was possible to put such a tool in a chemical works for the compression of gases possibly containing corrosive fumes. Such a pump required electricity valued at £150 per annum, and this compared with £500 for a mixed plant; £700 for three-stage compression; £1060 for two-stage compression, high pressure; and £1260 for four-stage low pressure. In none of these cases had he taken any credit for low-grade heat from the ejector. He was most anxious to justify the use of ejector air pumps, for they obviously had tremendous advantages in maintenance, space occupied, foundations and everything else, and, having regard to the vast difference between the £150 for mechanical pumps and the other figures he had mentioned, he would like to be told where he was wrong.

A. This was a case which required individual investigation and could not be argued without the full details being known. Possibly, if surface condensers were allowed for, the operating costs could be improved in the ejector schemes. Rotary pumps of the type suggested were not likely to stand up to the conditions described.

Treatment of Organic Growths

Q. Organic growths formed in surface condensers and increased the power consumption enormously and reduced the capacity of the plant. Chlorine treatment made an astounding difference to the vacuum in many refrigeration plants, for instance, as the cooling surfaces were maintained clean. A constant trickle of chlorine was quite useless; periodic shock treatment was necessary, using quite large quantities of chlorine.

A. Chlorine in circulating water does prevent the growth of algae.

Q. In reciprocating pumps, condensation must be drained from the cylinders; was it not desirable to design so that the condensed liquid would run out and be discharged downwards and not to design the discharge upwards, as at present, with the result that it came into contact with the valves, ports and cylinders?

A. In horizontal reciprocating air pumps, the design is generally such that the cylinder ports could not be arranged on the bottom, because of mechanical difficulties in arranging the valve gear. A vertical pump would probably be more suitable for draining. (*Note*: If fairly large quantities of moisture tend to come over with vapours, a simple separator can be arranged in the air line to take out this moisture).

Waste-Steam Recovery

Q. Experience with steam-jet ejectors and mechanical pumps for evacuating in a chemical process, using a vacuum of a very moderate order, about 20 in., showed that with the steam jet ejector, about three times as much steam was used as with the mechanical pump. This brought into prominence the whole question of the recovery of the waste steam. Steam jets in a particular process were taking 600 lb. of steam per hour and the exhaust steam could not be used, and, therefore, the process was saddled with the loss of some 400 lb. of steam per hour. The speaker had therefore looked into the efficiency of the jets and measured their thermodynamic efficiency. The jets were the usual commercial type and the efficiency, as measured on the reversible scale, worked out at about 10 per cent. Articles in the German Press, on the use of steam jets in the condensed-milk industry, claimed quite fantastic efficiencies, but personally, he had never succeeded in getting much more than 10 per cent. on the isothermal basis. The efficiency of a de Laval turbine, for the size of pump in question, was of the order of 40 per cent., and if that were coupled to a rotary pump it might explain the difference in the amounts of steam used. The great disadvantage of high-speed rotary pumps was corrosion. In the speaker's plant the original steel plates of the valves corroded away and were then replaced by phosphor bronze. Then the shaft corroded. Was not the only solution to make the whole pump of phosphor bronze?

A. A 20-in. vacuum with a single-stage ejector, would involve high steam consumption, and when using vacuum of this order some other system than the use of an independent air pump should give better results, *e.g.*, by borrowing from another system in the factory which normally operates at a high vacuum. (It was also suggested that a rotary pump made of plastics would be proof against corrosion).

Q. What would be considered the greatest vacuum available with a jet condenser? With 0.1 mm. vacuum absolute, would the author consider a multi-stage jet would be a satisfactory proposition?

A. No. (*Note*: This question appears to confuse ejectors and jet condensers).

Q. What would be the cost of producing vacua of various degrees? It was stated at the last meeting that in fine grinding, the cost went up in proportion to the fineness of the grind-

(*Continued on page* 214)

New Apparatus

Variable Speed Drive : A British Colorimeter

THE accompanying photograph (Fig. 1) illustrates an infinitely variable speed drive, made by Crofts (Engineers), Ltd., Thornbury, Bradford, and incorporating a Crofts' Patent V-rope variable-speed pulley. This is installed in a brickworks and drives an extruding machine. The motor speed is 720 r.p.m. and the driven shaft runs at any speed between 285 and 460 r.p.m. It will be noted that handwheel control of speed variation is obtained, but this may be replaced by a chain sprocket for remote control, or electrically operated push-button control can be provided.

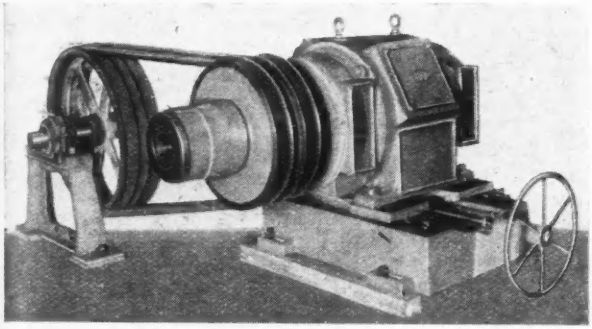


Fig. 1. Croft's infinitely variable speed drive.

The principle employed to obtain speed variation is that of expanding and contracting zones, forming V-groove pulleys of infinitely variable pitch diameters. There are no steps or jumps in speed, speed variation being infinitely progressive, upwards or downwards, within pre-determined limits, the speeds being varied with the machinery running. The V-ropes always remain central in grooves and in line at all speeds, this being achieved by a unique arrangement of the slides in the adjustable base, which compensates for the movement of the sliding cone in the variable-speed pulley.

Many thousands of these drives have been installed and are in use in all trades. The range of V/S pulleys is standardised to transmit from fractional horse-powers upwards to 70 h.p., with speed variations from 2-1 up to 8-1. Any required speed reduction can be arranged for, either by employing driven pulleys of different diameters, or (for very large reductions) by combining the V/S pulley drive with Crofts' reduction gear units.

The use of a plunger-type colorimeter for comparing the concentration of two solutions, by the application of Beer's Law, is a firmly established technique. A solution of known qualitative composition but unknown concentration is compared with a similar solution of known concentration, and the concentration is calculated as proportional to the respective heights of the two liquids in the colorimeter cups when the two colours, viewed in the eyepiece, appear equal. The need for a really first-class instrument of British manufacture has been intensified by war demands, and The Tintometer, Ltd., The Colour Laboratory, Salisbury, in conjunction with its associated company, Optical Glass Accessories, Ltd., is now able to offer such an instrument of original design, the result of much thought and experimental work. It is claimed that with this instrument, a high order of accuracy can be obtained with the greatest ease.

The "Ogal" colorimeter here illustrated is a strong aluminium casting of "stream-line"

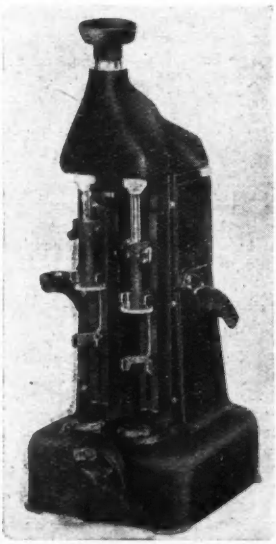


Fig. 2. "Ogal" colorimeter showing micro cups and plungers in use.

design, with a chemically resistant stoved black finish relieved by nickel-plated fittings. It is 16 in. high, 8½ in. deep, and 6 in. wide, and weighs (including accessories and 6 ft. of electric cable) about 17¼ lb. The mechanism is wholly enclosed, and the instrument is easy to clean. The drum scales are calibrated in tenths of millimetres; a built-in light source provides illumination equal to internationally standardised north daylight; and spring-loaded Monel claw cup-holders are provided. These make the cups self-centring; prevent accidental breaking through overwinding; and hold the cups firmly when the plunger is disengaged.

Black glass cups and plungers are fitted (*see* Fig. 2), with optically polished fused-on clear glass bottoms. They are free from distortion and unaffected by corrosion. The prisms are double-reflecting, hence there is no reversal of fields, and all prisms are carefully paired, to avoid any colour or brightness discrepancies. Full particulars of construction and instructions for use are included in a booklet issued by The Tintometer, Ltd., and supplied on application.

New British Standards

Salt-Glazed Pipes

SPECIFICATION B.S. 1143, just issued by the British Standards Institution, provides for salt-glazed ware pipes which have chemically resistant properties somewhat higher than those normally associated with pipes supplied to B.S. 65. These special pipes are required for use in chemical works, etc., where the drain effluents contain a considerable proportion of acids. If the effluent is at a comparatively high temperature, as it often is, the use of a drain-pipe having special chemically resistant properties becomes essential, and it is to provide pipes for use under these special conditions that the specification has been prepared. The form of the specification and the range of sizes and fittings covered are identical with those in B.S. 65. In addition to a special test for chemical resistance, the pipes have to be subjected to a higher pressure test than for the normal drain-pipes.

Testing Lacquers for Food Cans

A new British Standard for the testing of lacquers for the internal coating of thermally processed food cans is numbered B.S. 1149. The present shortage of tin has necessitated greatly increased use in the canning industry of what are therein known as phenolic meat lacquers. These are lacquers whose dried films consist substantially of resins formed by the condensation of formaldehyde with phenolic compounds.

The use of untinned blackplate for the ends of cans for all non-acid processed foods for home consumption called for a lacquer for both internal and external use with much greater resistance to processing in steam and fat than had been necessary when tinplate was used. It has been found that only the phenolic meat lacquers possess the required properties. Further, the use of the high melting silver-lead alloys in place of the tin-bearing soft solders for soldering the side seams of open-top food cans caused scorching of elæo-resinous lacquer inside the cans, and again the phenolic meat lacquer was the only one found to have complete resistance to scorching at high temperatures.

The routine methods for the testing of phenolic meat lacquers are set out in Part I of the specification. These methods are those employed in the Research Department of the Metal Box Co., Ltd. This system of tests normally requires many months for its completion, and in fact consists, in the last analysis, of using the lacquer under test for coating cans that are to be subjected for prolonged periods to the actual conditions of storage. Canned foods purchased by Government departments usually have to be accompanied by a two years' warranty, and it is with a view to this necessity that such a prolonged testing procedure is employed before any change in materials is adopted.

The possibility of a sudden change in the raw-material situation makes it essential that some means should be devised of determining in a much shorter time whether a new lacquer can reasonably be expected to give satisfactory performance. In order, therefore, to expedite the testing of new formulations, the simple series of tests described in Part II have been drawn up to enable lacquer-makers, and others who have no can-making equipment, to carry out rough preliminary sorting tests for themselves. Only lacquers which pass all the tests in Part II should be sent to can-makers for subjection to those in Par I.

Copies of the above specifications may be obtained from the B.S.I., 28 Victoria Street, London, S.W.1, price 2s. post free.

War conditions have afforded a wonderful opportunity for a great and lasting improvement in relations between employers and employed, said Mr. G. N. Ditchburn, addressing Liverpool Rotary Club last week. Better wages, canteens, welfare work and so forth, which were regarded by some workers with suspicion, were not the limit of management's responsibility. The really difficult and important part was to develop the workers' mental attitude to their job so that they felt they had a stake in the undertaking. He strongly advocated joint consultations, which threw overboard the idea of autocratic control and substituted the idea of a joint venture.

Plasticity of Coal

Improved Measuring Device

THE plasticity of coal is important in so far as it seems to determine—along with the external conditions of temperature, particle-size, etc.—the value of the coke produced. Several methods of its measurement are known but none is quite satisfactory. If, *e.g.*, the deformation of a coal briquette under load is observed, it depends on the gas evolution as much as on the plasticity proper. The rate of penetration of a needle into the coal is variable because of the variable area of contact between coal and needle and also since "bubbling" of coal changes the nature of this contact. A better apparatus is the Davis plastometer, and the device suggested by N. Kushnirevich* is somewhat similar to this.

In this method coal is spread on the bottom of a cylinder (about 0.4 gm. per sq cm.). On to the coal layer a chequered metal disc is placed; it is perforated to allow gases to escape and can be loaded with various weights. The coal layer is heated; when the temperature reaches 280°C., the disc is made to rotate and the momentum required for a uniform rotation is measured. This determination is repeated at various temperatures, keeping the rate of the temperature rise constant at 6°C. per minute. In this way a curve "momentum of force against temperature" is found. A similar curve is determined for another load on the rotating disc. These two curves are sufficient for characterising the coal sample.

When a rich coal is heated above 280°C. the momentum first remains constant, *i.e.*, the curve is horizontal. At a temperature which is peculiar to every kind of coal the curve bends downwards, *i.e.*, less force is required to rotate the disc; this temperature is usually near 450°C. On further heating the curve passes through a minimum near 500°C., rises rapidly to a maximum near 550°C., and drops again at even higher temperatures. As long as the momentum is independent of temperature (in the example above between 280° and 456°C.) it is the higher the greater is the load on the disc, and the friction between disc and coal has the features of a solid friction. At and near the minimum—*e.g.*, between 450° and 520° in the example given above—the momentum is independent of the load on the disc, *i.e.*, the coal behaves like a viscous liquid. Above 520° decomposition of the liquid and formation of a new solid begin, and the momentum is both high and dependent on load. When the solid has formed completely it is mechanically weak, and the momentum decreases again, the difference between the momentum values at different loads remaining large.

Various coals differ as to the presence or absence of a minimum on their momentum-temperature curves, and, if the minimum is present, as to its depth and width. Comparison of these curves with the properties of the metallurgical coke produced from the coal concerned shows that the coke qualities are higher for coal varieties showing a minimum, and the higher the greater is the temperature range in which the coal is "liquid," *i.e.*, where the momentum values are independent of load.

* *Zavodskaya Laboratoriya* ("Works Laboratory") 1940, 9, 1119.

Tallows and Greases

Divergent Views on Distribution

IN the annual report of the Seed, Oil, Cake, and General Produce Association, Liverpool, it is stated that apprehension as to the future has been expressed by brokers in home-melt tallows and greases, in view of the lack of provision for their services in the Fabon organisation set up to deal with the distribution of these commodities. A meeting was arranged with representatives of the London Oil and Tallow Trades Association to make an approach to Fabon, Ltd. The latter, however, confirmed their decision not to employ brokers in connection with the allocation scheme for home-melt tallows and greases, and expressed the opinion that the question of the services of brokers after the war did not arise for discussion at this stage. The support of the Soap Makers' and Fat Splitters' Federation was sought. They replied that their members were at liberty to make use of the services of brokers in connection with allocations from Fabon factories, but that since the method of distributing available material is arranged to meet the requirements of the Ministry of Food, it was not clear how such services could usefully assist.

Proposed Specification

A sub-committee of the Soap Makers' Association has investigated the matter of tallow specifications, and has made the following proposals, which have been approved by the Association's council: (1) Tallow should be defined as the fat derived from the bodies of ox and sheep, excluding fats from the bones and skin. (2) Its titre should be not less than 41.5°, by the Dalican method; the iodine value by the Wijs method to be not higher than 47; unsaponifiable matter not to exceed 1 per cent. (3) All tallows to be sold on a basis of a maximum of 2 per cent. dirt and moisture-content. A suggested grading table and other particulars can be found in the January number of *Soap, Perfumery and Cosmetics* (p. 53). The S.M.A. intends approaching the Ministry of Food in the hope of securing an officially agreed standard.

The Trend of War-Time Earnings

An Analysis of Company Accounts

by S. HOWARD WITHEY, F.C.I.

ENLARGED activities are revealed in the reports of companies operating processes for the production of non-inflammable and non-conducting materials, and in the case of Erinoid, Ltd., the gross earnings of the twelve months ended July 31 last represent an increase of £16,255 in relation to 1941-42. The trading profit and other income amounted to £122,940 as compared with £106,685, and although only £9727 was provided for depreciation, the sum reserved for taxation is £28,919 higher at £95,306, so that the balance of net profit is £15,974, a decline of £9552. This company was registered in 1915 in the reconstruction of Syrolit, Ltd., and has an authorised capital of £330,000, all of which has been issued, consisting of £55,000 in the form of 6 per cent. cumulative preference stock—the dividend on which is paid half-yearly in January and July—and £275,000 in ordinary stock, on which a dividend of 10 per cent. has been paid for the past three years, after 6 per cent. in 1939-40. The production of plastic materials is being developed, and the company has a laminated fabrics department, now engaged on war work, which is likely to prove very advantageous in the post-war period.

The following is a summary of the final figures for the past year :—

		£
Brought forward from 1941-42	...	8374
Net profit—year ended July 31, 1943		15,974
Disposable balance	...	£24,348
6 per cent. dividend on £55,000 cum. pref. stock	£3300	
less income tax at 10s. in the £	1650	1650
10 per cent. dividend on £275,000 ordinary stock ...	£27,500	
less income tax at 10s. in the £	13,750	13,750
Carried forward to 1943-44 ...	...	8948
		£24,348

After deducting depreciation, the fixed assets are shown on the balance sheet at £117,784, an increase of £4282 during the year, and, excluding £69,513 in enemy-occupied countries, the floating assets amount to £430,641 as against £397,776 at the close of the previous period. At the recent price of 11s. 6d., the ordinary 5s. stock units give a return of 4.4 per cent.

The purification and conditioning of water for chemical engineering purposes constitutes an important branch of engineering work, and the general tendency of earnings is in an upward direction. During the financial year to the end of April last, for example, the net earnings of Paterson Engineering Co., Ltd., amounted to £10,786, which figure compares with £10,351 realised in 1941-42. This enables the ordinary dividend of 12½ per cent. to be maintained, and the forward balance to be raised from £45,395 to £47,614. Registered in 1902 and converted into a private company in 1908, the company was reconverted into a public concern in 1933. It specialises in the designing and supply of water purification equipment, and directly controls the Southall Engineering Co., Ltd. The authorised capital is £200,000, of which a total of £179,075 has been issued and fully paid, comprising £75,000 in the form of 5½ per cent. cumulative preference £1 shares, and £104,075 in ordinary shares of 10s. denomination. The final figures for the past year are given below :—

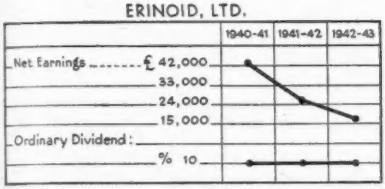
		£
Brought forward from 1941-42	...	45,395
Net profit—year ended April 30, 1943		10,786
Disposable balance	...	£56,181
5½ per cent. dividend on £75,000 cum. pref. shares	£4125	
less income tax at 10s. in the £	2063	2062
12½ per cent. dividend on £104,075 ordinary shares...	£13,010	
less income tax at 10s. in the £	6505	6505
Carried forward to 1943-44 ...	...	47,614
		£56,181

In spite of a decline in the value of the stocks and work in progress, the floating assets amount to £458,528, representing an increase of £53,079, the floating surplus over the current liabilities being £45,409 as compared with £34,048. Interests in subsidiary and associated companies are shown on the balance sheet at £170,313, and other fixed assets are valued at £10,967. The financial position of the company has steadily improved, and at the recent price of 24s. the ordinary shares yield 5.2 per cent.

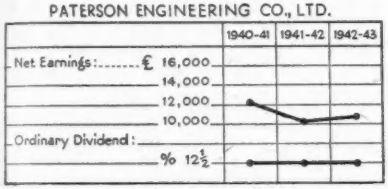
Firms specialising in the production of boilers, fuelling equipment and tanks are able to report satisfactory results, and in the case of Thompson Brothers (Bilston), Ltd., the gross earnings for the year to the end of July last amounted to £57,534. This figure is arrived at after providing for E.P.T., and compares with £59,146 in 1941-42, and £54,926 in 1940-41. After debiting income tax, war damage contributions, and A.R.P. expenditure, the balance of net profit is £18,734, as against £18,671 in 1941-42 the latter figure being increased to £28,492 by including £9821 recovered from E.P.T.; consequently, the distribution on the ordinary

capital is maintained at 22½ per cent., and £10,000 added to the general reserve, bringing that fund up to £85,000. Registered privately in 1906, this company was converted into a public company in 1937, and has an authorised capital of £170,000, of which a total of £100,000 has been issued and fully paid. This consists of £10,394 in the form of 6 per cent. tax-free

ERINOID, LTD.



PATERSON ENGINEERING CO., LTD.



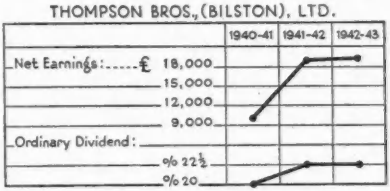
cumulative preference £1 shares, and £89,606 in ordinary 5s. stock units. The final account is balanced in the manner indicated below :—

		£
Brought forward from 1941-42	...	16,652
Net profit—year ended July 31, 1943		18,734
Disposable balance	...	£35,386
6 per cent. dividend on £10,394 cum. pref. shares, tax free	... ...	624
22½ per cent. dividend on £89,606 ordinary stock	£20,161	
less income tax at 10s. in the £	10,081	10,080
Transferred to general reserve	...	10,000
Carried forward to 1943-44	...	14,682
		£35,386

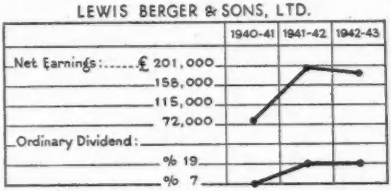
The fixed assets have been written down from £90,550 to £86,949, but the current assets have increased from £594,519 to £634,288, the working surplus over the current liabilities being £110,714 as against £99,083 previously. A year ago, the ordinary 5s. units were quoted around 13s. 9d., but at the recent price of 17s. 3d. the actual yield is about 6½ per cent.

Further recovery has been reported by the directors of Lewis Berger & Sons, Ltd., the well-known paint manufacturers, as the result of increased production during the financial year ended July 31 last. Rising costs have meant restricted profit margins, but these have been offset by technical improvements in manufacturing, and including the income received from subsidiaries the gross earnings amounted to £348,791. This figure compares with £326,907 shown in the previous account, but as taxation required £144,000 or £34,000 more than in 1941-42, the balance of net profit is £12,116 smaller at £188,791. Bergers have been making paints and colours for 183 years, and an unrivalled experience in laboratory and factory is brought to bear on individual finishing

THOMPSON BROS., (BILSTON), LTD.



LEWIS BERGER & SONS, LTD.



problems. The authorised capital of the company is £1,000,000, of which a total of £927,275 has been issued and fully paid, comprising £400,000 in the form of 7 per cent. cumulative preference £1 shares—the dividend on which is paid half-yearly in April and October—and £527,275 in ordinary £1 shares upon which the dividend of 19 per cent. is repeated. After transferring the sum of £50,000 to the general reserve, the forward balance shows an increase of £10,609, thus :—

		£
Brought forward from 1941-42	...	121,227
Net profit—year ended July 31, 1943		188,791
Disposable balance ...	...	£310,018
7 per cent. dividend on £400,000 cum. pref. £1 shares, gross	... ...	28,000
19 per cent. dividend on £527,275 ordinary shares of £1, gross	...	100,182
Transferred to general reserve	...	50,000
Carried forward to 1943-44 ...	...	131,836
		£310,018

After deducting depreciation, the fixed assets are slightly higher at £352,796, while the current assets have increased from £627,315 to £787,172, the floating surplus over the current liabilities being £160,362, which compares with £149,942 a year ago. At the recent price of 34s. the preference shares gave a return of 4.1 per cent., and at 93s. the ordinary yield just over 4 per cent. A year ago the ordinary shares were quoted around 74s.

Personal Notes

SIR ROBERT ROBINSON, Waynflete Professor of Chemistry in the University of Oxford, is to receive the honorary degree of Doctor of Laws of St. Andrews University at the graduation ceremony to be held on June 30.

MR. M. A. CONDELL has been re-elected president of the Association of British Organic Fertilisers, Ltd., MR. H. G. CHAMBERLAIN succeeds Mr. S. L. Sheldrick as vice-president, and MR. H. J. SAYWELL takes Mr. Chamberlain's place as honorary treasurer.

DR. G. T. O. MARTIN has given up his position as research officer to the joint committee on vitreous enamelling of the Institute of Vitreous Enamellers and the B.C.I.R.A., and has taken up an industrial post. He will no longer edit the *Enamelling Abstracts*, and separate publication of this periodical will now cease.

MR. H. E. G. WEST, managing director of Newton Chambers & Co., Ltd., has been appointed also managing director of Thorncliffe Coal Distillation, Ltd., an undertaking operating a large coking and by-products plant. Recently, he was appointed a director of Yorkshire Tar Distillers, Ltd., and he has also lately joined the boards of the South Yorkshire Gas Grid Company and of Hallamshire Coal Supplies, Ltd.

PROFESSOR ALEXANDER R. TODD, F.R.S., D.Sc., D.Phil., F.I.C., Sir Samuel Hall Professor of Chemistry and Director of the Chemical Laboratories at Manchester University since 1938, has been elected Professor of Organic Chemistry at Cambridge University from October 1. Professor Todd studied at Glasgow, Frankfort-on-Main, and Oxford, and has held positions in the chemistry department of the Universities of Edinburgh (1934-6) and London (1936-8). He was awarded the Meldola Medal in 1936, was visiting lecturer to the California Institute of Technology in 1938, and gave the Tilden Lecture in 1941. He is the son-in-law of Sir Henry Dale, P.R.S.

SCIENCE IN INDUSTRY

Four of the country's leading authorities on science in relation to industry are to address members of Manchester Chamber of Commerce in the near future. The first meeting is on March 3, when Lord Riverdale, the Sheffield engineer and industrialist (formerly Sir Arthur Balfour), will speak on "Research and Industry: the Need, the Ways, and the Means." Later speakers will be Sir Edward Appleton, secretary to the D.S.I.R. (March 16); Dr. Andrew McCance (March 31); and Dr. A. P. M. Fleming (April 20).

Fuel Efficiency Lectures, VI

(*Continued from page* 208)

ing. Was that true of vacuum? Should a warning be issued to chemical manufacturers not to ask for any higher vacuum than is necessary?

A. The cost of producing vacuum does increase with the degree of vacuum.

Q. Do steam ejectors wear as do boiler steam jets?

A. The wear on the jets is generally very little. With wet steam there is more wear than with dry steam or slightly superheated steam, but the nozzles would still operate for years without a great deal of wear. (*Note*: Operating steam for ejectors should be reasonably dry to give satisfactory results.

Water Ejectors

Q. Can information be given as to the economics of water ejectors? These have a somewhat complicated rotary nozzle system and the jet of water was used in conjunction with a Venturi to produce a vacuum.

A. The water ejector has been operated in power stations, but it has never been able to compete with the steam ejector. In certain circumstances it could maintain quite a reasonable vacuum, but experience indicates that those who had tried it had gone over very quickly to the steam ejector. (*Note*: The questioner may have been referring to the rotary air pump of the Leblanc type mentioned in the paper, and not to the type of water ejector assumed in the answer).

Q. The amount of vacuum required (*e.g.*, 20 in.) by many questioners does not seem to justify a steam ejector. Can anything be said about the speed with which high vacuum could be obtained with the steam ejector? There is a tendency to decry steam ejectors and to lose sight of the fact that they could be fuel savers because of their speed of operation and their high efficiency. Where high vacuum was required, steam ejectors were both efficient and economical.

A. The steam-ejector air pump is frequently used to build up vacuum quickly in a system. One application of this sort is mentioned in the paper where reference is made to building up vacuum in operating vessels working under vacuum in batch processes. It is agreed that the ejector air pump is not light on steam when the vacuum required is only 20 inches.

Q. What is the relative quantity of steam required for the steam-ejector condensers at different pressures, say, 200 lb., 90 lb., and 40 lb.?

A. It depends upon the conditions, and it is not easy to give figures which would apply to all conditions. A two-stage ejector if worked at a vacuum of approximately 25 to 26 in., would take only about half the steam required by a single-stage ejector compressing from the same vacuum to atmosphere in one stage.

General News

The need to bring new industries to Bradford was stressed at the last meeting of the City Council.

The Paper Makers' Association of Great Britain and Ireland has formed a research association for the paper and board making industry.

The Minister of Health last week extended an open invitation to all M.P.s to send him "all information relative to the production and application of penicillin."

The Board of Trade has granted a temporary licence for the manufacture of domestic aluminium articles in Scotland, reports the *Glasgow Herald*.

The Foreign Secretary was asked whether he would extend the embargo on oil to Spain to cover shipments of coal. Mr. Eden replied that he had no statement to make on that subject.

In respect of the period beginning March 3 and ending June 2, 1944, the rate of premium payable under any policy under the Commodity Insurance Scheme shall continue to be at the rate of 5s. per cent. for three months (or 1s. 8d. per cent. per month).

A commission to report on the problems involved in the supply of scientific equipment to the occupied countries after they have been freed has been set up by the Conference of Allied Ministers of Education. Dr. E. F. Armstrong is the commission's chairman.

The Alcohol Control, Ministry of Supply, is permitting the use of alcohol to the extent of 25 per cent. of a manufacturer's previous production of tincture of belladonna. Pharmacists are asked to use the tincture solely for N.W.F. prescriptions.

An interim report of the Welsh Advisory Council on Post-War Reconstruction is being printed. Sir W. Jowitt said last week that the recommendations in this report concern many departments, but he did not think any useful purpose would be served by enumerating them at this stage.

The first Cantor lecture delivered by the director of the Geological Survey, Dr. E. B. Bailey, F.R.S., dealt with flint, copper, tin and coal. Dr. Bailey expressed the hope that research into underground gasification of coal would be taken up in all parts of the world.

A tentative agreement for the purchase of 100,000 tons of silica sandstone on Hebden Moor, Skipton, Yorks, has been concluded between English Silica Industries, Ltd., and representatives of the holders of the manorial rights. The price has been fixed at 6d. per ton, and the agreement includes an option to purchase further instalments of the same quantity at the same rate.

From Week to Week

A new Ministry of Labour pamphlet sets out the grants and allowances available to workers who are transferred to work of national importance beyond daily travelling distance of their homes, and who are not entitled to similar allowances from their employers. A summary of the allowances available is set out clearly on the back of the leaflet, and instructions are given as to how these grants may be obtained.

Delivery of lime to Scottish farmers was criticised in the Commons last week by Sir R. W. Smith, who referred to the case of one farmer who had to wait six months for his order. The Secretary of State for Scotland said that adequate supplies of shell sand and waste lime was available in the N.E. area, but admitted some delay in deliveries of ground limestone. He added that a new limestone grinding plant would shortly be erected with State aid at Dufftown, Banffshire, to assist that particular area.

An increase in the number of scientists on the Scientific Advisory Committee for Scotland, as contrasted with medical men, was advocated by Major Markham in the House last week. Mr. Johnston said he was considering this suggestion, but his present view was that it would be better to continue the existing arrangement whereby the committee could co-opt any person, scientist or other, whose expert knowledge would be useful in connection with any particular matter under review.

In view of the discussion on "Plastics and the Coal Tar Industry" which the Plastics section of the S.C.I. has arranged for next Monday (*see* p. 216), the paper read by Dr. W. D. Scott, chief chemist of Monsanto Chemicals, Ltd., on January 5 at Birmingham, is of particular importance. The paper dealt with chemical raw materials in relation to synthetic resins, and was briefly summarised in *Chemistry and Industry* (January 22, p. 34). We propose to make editorial reference to it in a future issue.

"The Use of Statistical Methods in Leather Research" was the title of a paper given by Dr. H. M. Davies to the International Society of Leather Trades' Chemists at Manchester on February 12. Dr. Davies said that leather technologists and research workers everywhere had been comparatively slow to appreciate the need for a statistical approach to their problem. His paper aimed at providing an introduction to statistical methods, with examples of the advantages they are capable of conferring, and gave instances of the analysis of grouped and paired data and of randomised block and latin square experiments.

The explosion of a tar still belonging to Monsanto Chemicals, Ltd., and situated in a North-East town, resulted in 16 workmen being injured. The men were gathered round the still, a 25 ft. high tank, trying to put out the flames where an overflow of boiling pitch had caught fire, when the tank burst, scattering hot pitch and masonry in all directions.

Sternol, Ltd., the oil refiners, have published an instruction card dealing with the correct method of care, maintenance, and general handling of barrels and drums, which is especially valuable now that the shortage of these packages makes proper attention essential. They will be pleased to send a copy of this card to anyone who applies to them, at "Grey Timbers," Westerham Road, Limpsfield, Oxted, Surrey.

Suggestions for the procedure to be followed to secure university status for Bradford Technical College were submitted to the Technical Education Sub-Committee of Bradford Educational Authority on Wednesday. The principal, Mr. H. Richardson, has stated that unless the College can discharge the functions of an institute of university standing, it will not meet the future requirements of industry and commerce.

Foreign News

Twelve leading heating engineers have been chosen by the director of the U.S. Bureau of Mines, Mr. R. R. Sayers, to form a national fuel efficiency council. This body will be responsible, in collaboration with the bureau, for organising a fuel efficiency campaign similar to that already working so effectively in Britain.

The Trading with the Enemy (Authorisation) Order, 1944 (S.R. & O. 1944, No. 76), rules that any person, unless the Board of Trade otherwise direct, may trade with any individual or body of persons carrying on business in the territory formerly known as Italian East Africa, Cyrenaica, or Tripolitania.

Oilseed cultivation in Chile has been much increased to meet the exigencies of wartime. Production of sunflower seed has risen from 1700 metric tons in 1939 to 13,000 last year. For hemp seed the respective figures were 4000 and 6000 tons. It is reported that a type of sunflower seed with 30 per cent. of oil has been developed.

Plans are being made, it is reported, for the large-scale production of penicillin in Australia. Plant costing £A65,000 has been officially sanctioned, and production has meanwhile begun in temporary premises. The Federal Health Minister has stated that he considers the drug so valuable that it ought to be produced in the Commonwealth laboratories rather than through the more limited facilities of private enterprise.

A wood saccharification plant is being built by Puukemia O.Y. at Heinola in Finland. Production will at first be confined to alcohol, but later it is to be extended to include dextrose.

The Consolidated Mining and Smelting Company of Canada is carrying on preliminary work on a power site on the Nation River in the Cassiar District, British Columbia, to provide power over a 60-mile transmission line to its Pinchi Creek mercury property.

Antimony has come under Government control in Canada. With the discontinuance of antimony production in Canada, the war exchange tax of 10 per cent. *ad valorem*, and the 3 per cent. special excise tax, have been removed from imports of antimony, or regulus of antimony not ground, pulverised or otherwise manufactured.

The first "wild rubber" plantation of the Government of India is to come into production this year, it is reported. The rubber-bearing plant in this instance, is *Cryptostegia grandiflora*, or pulay, a climbing asclepiad. Seeds collected from all over India were planted last summer in 5000 acres at Muttra, near Delhi, and will produce a few hundred tons of rubber this year. No really economic method of extracting the rubber has yet been evolved, and serious competition with plantation rubber is not envisaged.

Forthcoming Events

The Food Group of the **Society of Chemical Industry** is holding a joint meeting with the Nottingham section on **February 26,** at 2.45 p.m., in the lecture theatre of the Corporation Gas Showrooms, Nottingham, when Dr. V. L. S. Charley will lecture on "Fruit Juices and Related Products."

A lecture on "Protein Fibres—Their Chemical Properties and their Industrial Applications" will be given by Professor J. B. Speakman to the meeting of the **Royal Institute of Chemistry** to be held in the chemistry lecture theatre, King's College, Newcastle, on **February 28,** at 5 p.m.

The Plastics group of the **Society of Chemical Industry** and the **Association of Tar Distillers** are holding a joint meeting at Gas Industry House, Grosvenor Place, S.W.1, on **February 28** at 2.30 p.m. A discussion on "Plastics and the Coal Tar Industry" will be introduced by Dr. H. Levinstein and Mr. J. Idris Jones, of the Chemical Research Laboratory.

Two papers on brass electrodeposition will be presented to the **Electrodepositors' Technical Society,** London section, at their meeting, on **February 28,** at 5.30 p.m., in the Northampton Polytechnic, Clerkenwell. The

first, by Mr. J. Kronsbein and Mr. A. Smart, deals with "A New Development in Electrodeposition of Brass," and the other, entitled "Studies on Brass Plating," has been prepared by Mr. S. G. Clarke, Mr. W. N. Bradshaw, and Mr. E. E. Longhurst.

The Chemical Society, Manchester section, is holding a meeting in the chemistry lecture theatre of Manchester University at 5 p.m. on **February 29,** when a number of original papers will be read.

A discussion on "The Mechanism of Oxidation-Reduction Reactions" will be held at the joint meeting of the **Chemical Society** and **Leeds University Chemical Society** on **March 2.** The openers will be Professor H. S. Raper, Professor M. G. Evans, and Dr. W. A. Waters.

The British Association of Chemists, London section, meets in the Chemical Society's rooms, Burlington House, W.1, on **March 4,** at 2.30 p.m., to hear a lecture by Dr. T. J. Drakeley, principal, Northern Polytechnic, on "Training for the Chemical Industries."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

PLASTICRAFT LTD., London, N.W., plastic manufacturers. (M., **26/2/44.**) February 2, £3800 and £500 debentures, respectively to B. H. Gilbert, Addington, and L. Kramer, London; general charges.

BRITISH PLASTOIDS CO., LTD., Nottingham, plastic manufacturers, etc. (M., 26/2/44.) February 8, debenture, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; general charge.

Satisfaction

ENGLISH CLAYS LOVERING POCHIN AND CO., LTD., St. Austell, china clay manufacturers. (M.S., 26/2/44.) Satisfaction February 1, £20,000, registered July 28, 1939.

Company News

English China Clays, Ltd., announce a first and final dividend of 1 per cent. (same) on the ordinary shares for the current year.

Leeds Fireclay Co., Ltd., is paying no interim dividend (3 per cent.) on the 6 per cent. participating preference shares in respect of the year ending June 30, 1944.

Doulton and Co., Ltd., announce a dividen on the ordinary stock of 5 per cent. (same). A capital bonus of 5 per cent., tax free (same) is likewise recommended. Net profit for 1943 was £86,328 (£115,006).

E. I. du Pont de Nemours & Co., Inc., have announced a first interim dividend for 1944 of $1.25 a share. Last year three interim payments of $1 were followed by a final of $1.25.

New Companies Registered

Luminogenic Applications, Ltd. (385,423). —Private company. Registered February 7. Capital: £1000 in 1000 shares of £1 each. Manufacturers of luminous, fluorescent and other paints, etc. Directors: J. Cofman-Nicoresti, F. C. Laker. Registered office: Ashmead House, Disney Street, S.E.1.

Solo Household Products, Ltd. (385,404). —Private company. Registered February 5. Capital: £100 in 100 shares of £1 each. Manufacturers of and dealers in liquid ammonia, ammoniated products, chemical products, washing and cleaning preparations, etc. Subscribers: E. Newman, V. H. Frank. Vivian H. Frank is the first director. Registered office: 52 Walmer Road, W.10.

Chemical and Allied Stocks and Shares

IN the absence of improvement of business in the stock and share markets, movements in most securities have been small. Nevertheless, the general undertone was firm. British Funds have been quite well maintained, and there were various small gains among industrial shares. Imperial Chemical (38s. 3d.) tended to improve on expectations that the results, due in April, will create a good impression and confirm estimates that the dividend is likely to be maintained at 8 per cent. Lever & Unilever eased to 36s. 3d., but Borax Consolidated remained at 37s. 9d., awaiting the dividend announcement. General Refractories 10s. shares were better at 16s. 6d., on hopes that results for 1943 may show further recovery in profits and dividend. In respect of 1942, it may be recalled, the dividend was raised from 5 to 7½ per cent., which was a conservative payment. Dunlop Rubber at 40s. 6d. were unchanged on balance, while British Aluminium remained steady at 47s. 9d., and British Oxygen were again 80s. 6d. Murex at 102s. 6d. were

quite well maintained on balance, as were Metal Box ordinary at 89s. 4½d. Triplex Glass 10s. ordinary moved higher to 37s.

W. J. Bush continued firmly held and were quoted at 60s. "middle." Burt Boulton were 22s. 6d., and elsewhere Leeds Fireclay preference changed hands around 16s. 3d. B. Laporte were again 75s. Results of the last-named company are made up to the end of March and fall to be issued in June. Since the war, owing to the weight of taxation, increased trading profits have not been reflected in net profits; but earnings on the shares have been substantially in excess of the 15 per cent. dividend rate which has ruled since 1939-40. In other directions, British Plaster Board 5s. ordinary showed further improvement to 30s. Turner & Newall also continued their upward trend, and were 80s. 9d., compared with 80s. a week ago. The units of the Distillers Co. were slightly higher at 89s. 3d. Since the war the dividend of the last-named company has been reduced from 22½ to 16¼ per cent.; but, as usual, allocations to reserves, etc., have been on a generous scale. In respect of the year ended May last, over 25 per cent. was earned on the ordinary stock units.

Among textiles, Courtaulds tended to improve, pending the dividend announcement, and were 54s. 3d., compared with 53s. 9d. a week ago. British Celanese at 28s. were also better on balance, while Bradford Dyers' strengthened to 21s. 3d. Results of the last-named company are due shortly; now that preference dividends have been brought up to date, the market is hopeful that dividends on the ordinary shares will be resumed with a payment of 5 per cent. for the past year. Among other results awaited with interest are those of Dorman Long & Co. The ordinary shares have been well maintained at 28s. 7½d. at the time of writing. Stewarts & Lloyds held their recent improvement to 54s. 1½d. Dividend on the latter has been limited to 12½ per cent. for some years; in respect of 1942, fully 24 per cent. could have been paid if £500,000 had not been added to reserves.

In the plastics field, De La Rue have been maintained at 156s. 3d. British Industrial 2s. shares were firm at 6s. 9d. following publication of the financial results, while Erinoid 5s. ordinary were again 10s. 9d. Elsewhere, Lewis Berger continued their good tendency, and were 98s. International Paint remained at 115s., awaiting the dividend announcement. In other directions, Greeff-Chemicals 5s. ordinary were again 7s. 3d., Monsanto Chemicals 5½ per cent. preference were 23s., and British Drug Houses also 23s. Blythe Colour 4s. ordinary changed hands up to 9s. 4½d. Boots Drug 5s. ordinary rose further to 44s., and Sangers held their improvement to 24s. 1½d. Among oil shares, Anglo-Iranian were slightly higher on balance at 113s. 1½d.

British Chemical Prices

Market Reports

CONDITIONS in the London general chemicals market are reported steady, deliveries against existing contracts proceeding along satisfactory lines. No important price changes have been reported during the past week and values throughout the market display a firm undertone. In the soda products section, bicarbonate of soda, caustic soda, and nitrate of soda are receiving a steady inquiry, while the demand for soda ash and acetate of soda is maintained. Hyposulphite of soda continues to be taken up in fair quantities. The potash chemicals generally are in good demand and supplies of permanganate of potash and caustic potash are being steadily absorbed. A brisk inquiry is reported for acid phosphate of potash, and yellow prussiate of potash is available in limited quantities with quotations nominal. Elsewhere, a good demand is reported for formaldehyde and also for glycerine and borax. In the acid section values are well held, and the demand for tartaric, citric, and oxalic acid continues to exceed supplies available. Acetic acid is a strong market at the controlled levels and steady deliveries are being called for. Activity in the coal-tar products market is chiefly centred round deliveries against contracts, with little fresh business to report.

MANCHESTER.—There has been a well-sustained pressure for contract deliveries of the leading heavy chemicals on the Manchester market during the past week, with the general run of alkali products, lump alum, carbonate of magnesia, and ammonia compounds moving steadily. There is no lack of inquiries for potash materials but these are mostly in short supply. Fresh business during the week has been of moderate extent, and in many instances there have been few offers of supplies for prompt or near delivery. Quotations are very firm throughout the market, though actual changes have been of little consequence. With regard to the by-products there has been a steady flow of deliveries in both light and heavy secions.

GLASGOW.—In the Scottish heavy chemical trade there is no change from last week, home business remaining steady. Export trade is still rather limited. Prices keep very firm.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.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